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Cummings et al.

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(54) **IMPACT SOCKET**

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(51) **Int. Cl.**

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B25B 13/06	(2006.01)
B25B 19/00	(2006.01)
B25B 13/10	(2006.01)
B25B 21/02	(2006.01)

(52) **U.S. Cl.**

CPC ***B25B 13/06*** (2013.01); ***B25B 13/102*** (2013.01); ***B25B 19/00*** (2013.01); ***B25B 21/02*** (2013.01)

(58) **Field of Classification Search**

CPC B25B 13/06; B25B 13/56; B25B 13/04; B25B 13/065; B25B 13/102; B25B 13/105; B25B 19/00; B25B 21/00; B25B 21/02; B25B 23/0007

USPC 81/124.4, 124.5, 185, 186, 125.1, 81/124.6, 121.1, 125

See application file for complete search history.

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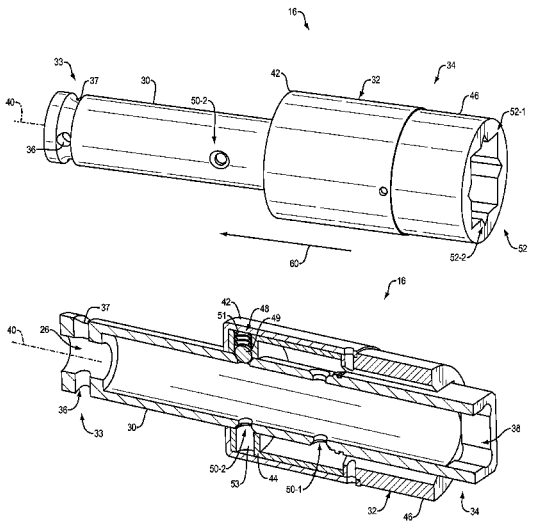
(57) **ABSTRACT**

An impact socket includes a socket body having a first end configured to mount to a drive shaft of an impact wrench and an opposing second end, the socket body defining at least one socket body fastener driving structure at the second end. The impact socket includes a collar assembly carried by the socket body, the collar assembly defining at least one collar assembly fastener driving structure. The collar assembly is configured to move linearly between (i) a first position relative to the socket body where a distal end of the collar assembly extends beyond a distal end of the socket body and (ii) a second position where the distal end is disposed at least equidistant to the second end of the socket body.

14 Claims, 9 Drawing Sheets



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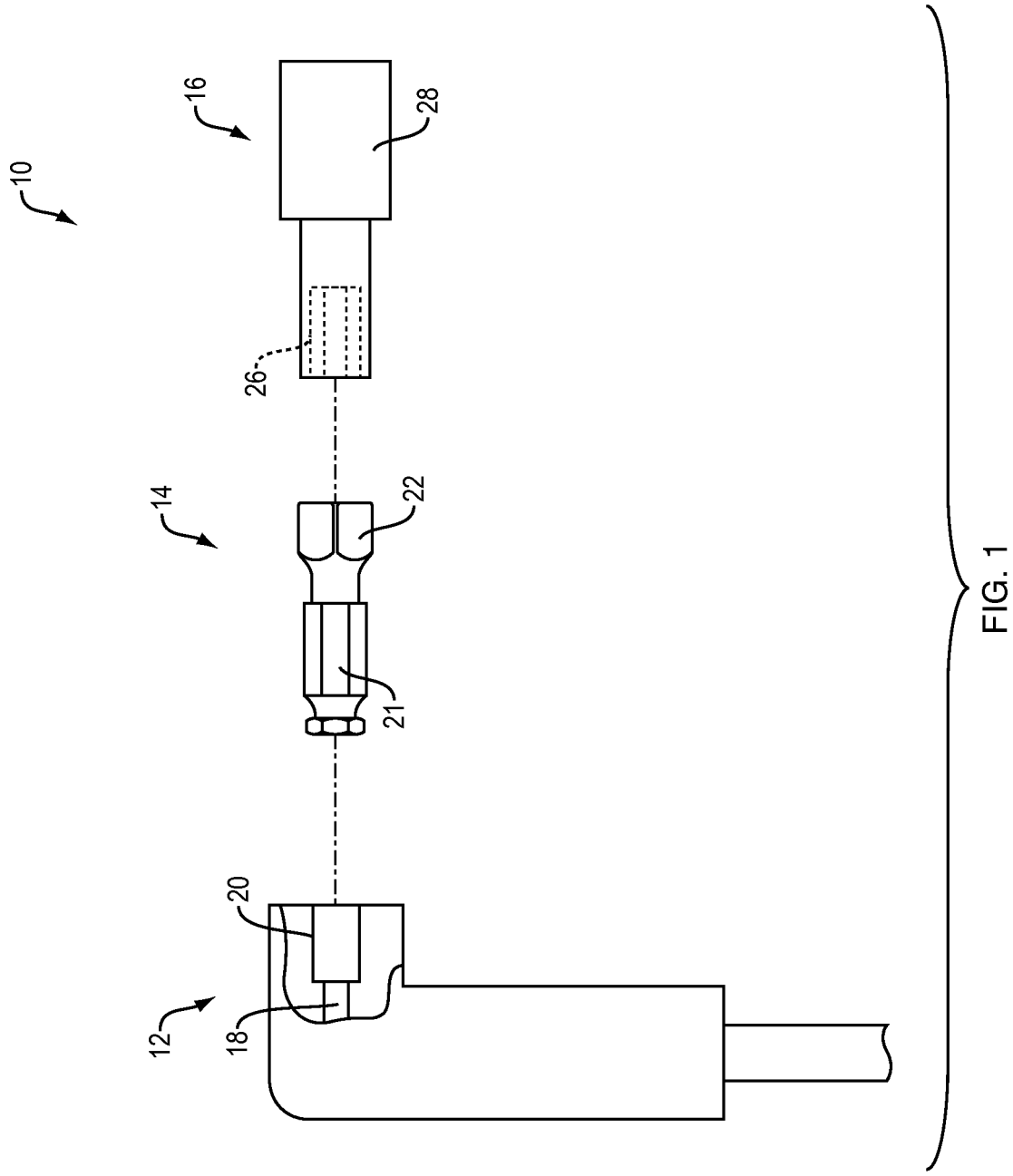

FIG. 1

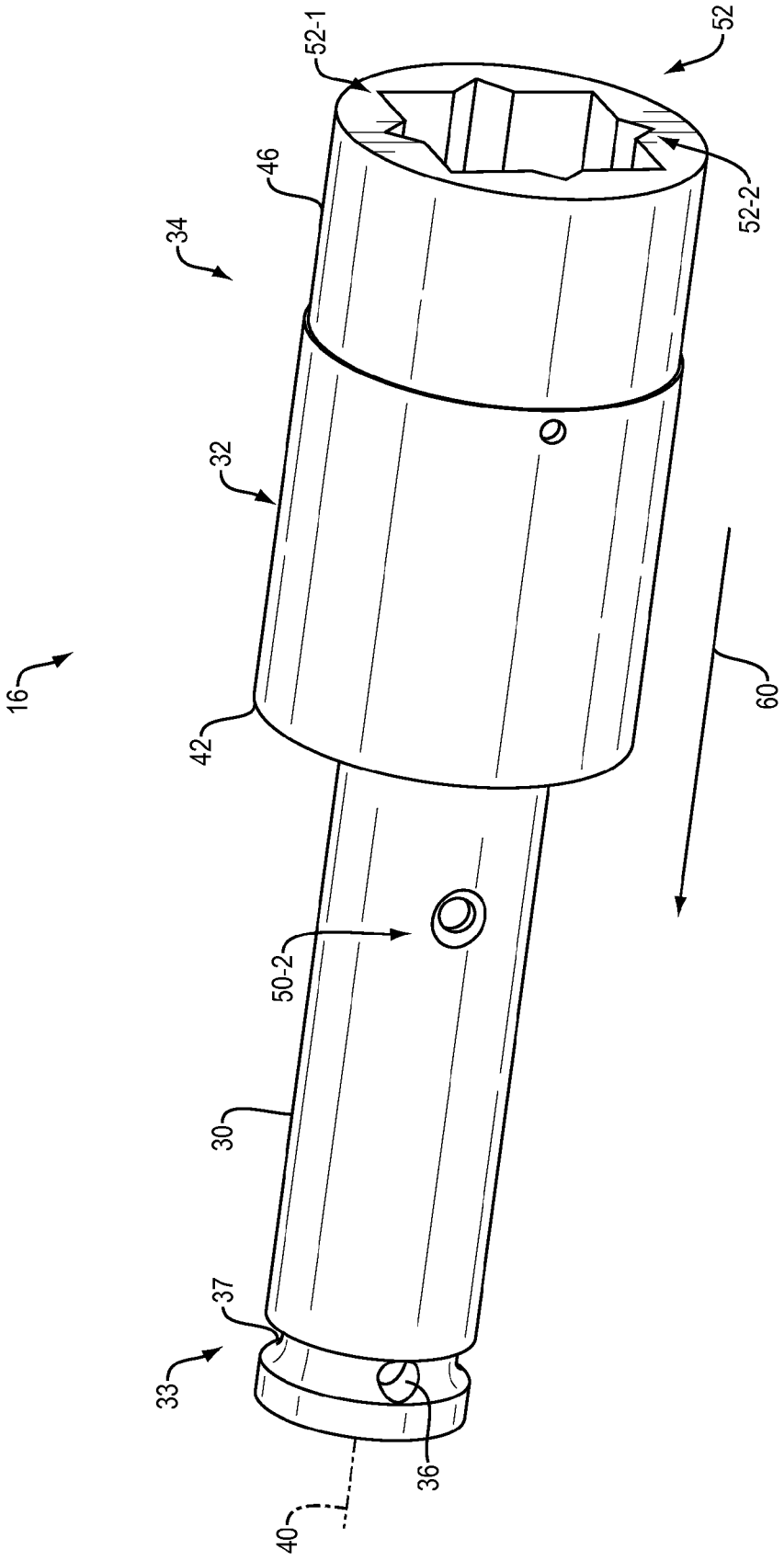

FIG. 2

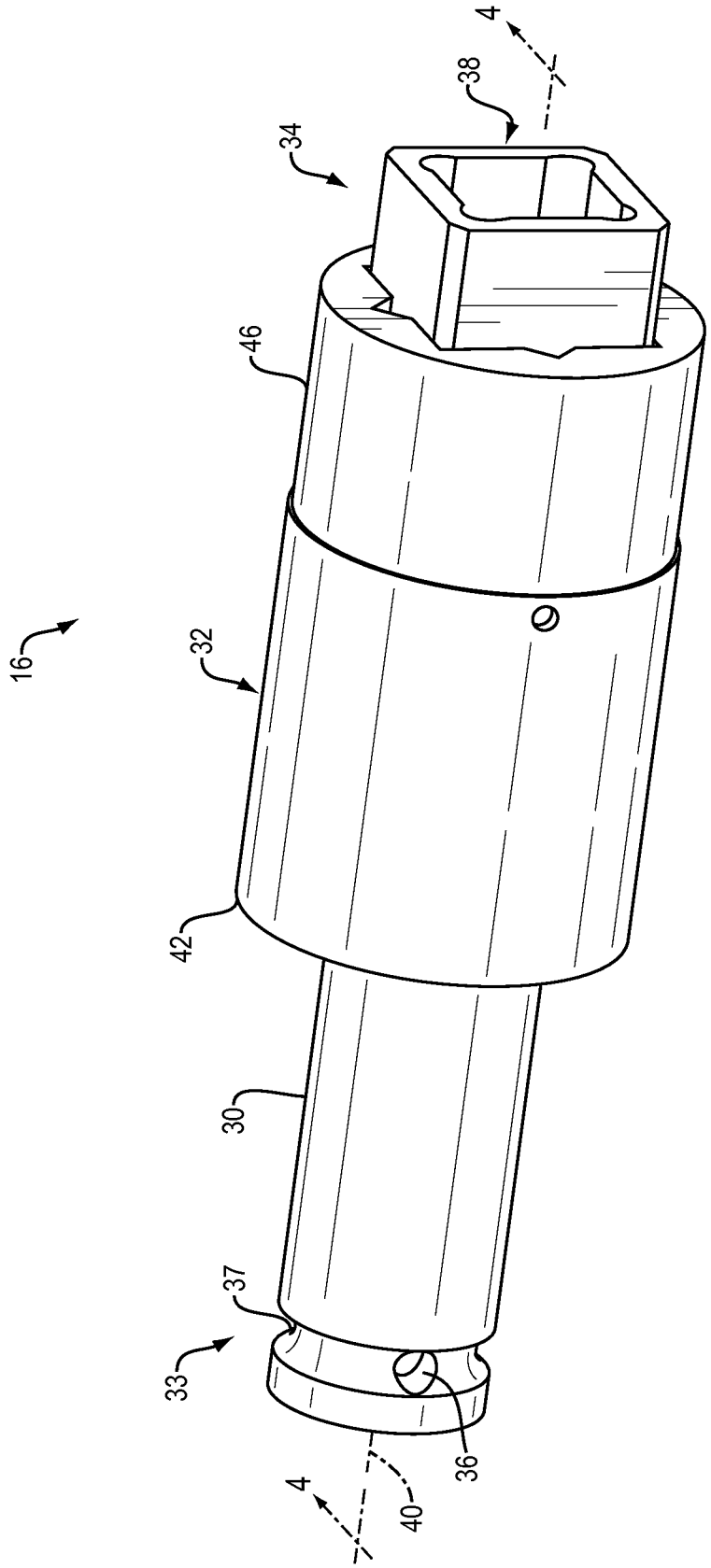

FIG. 3

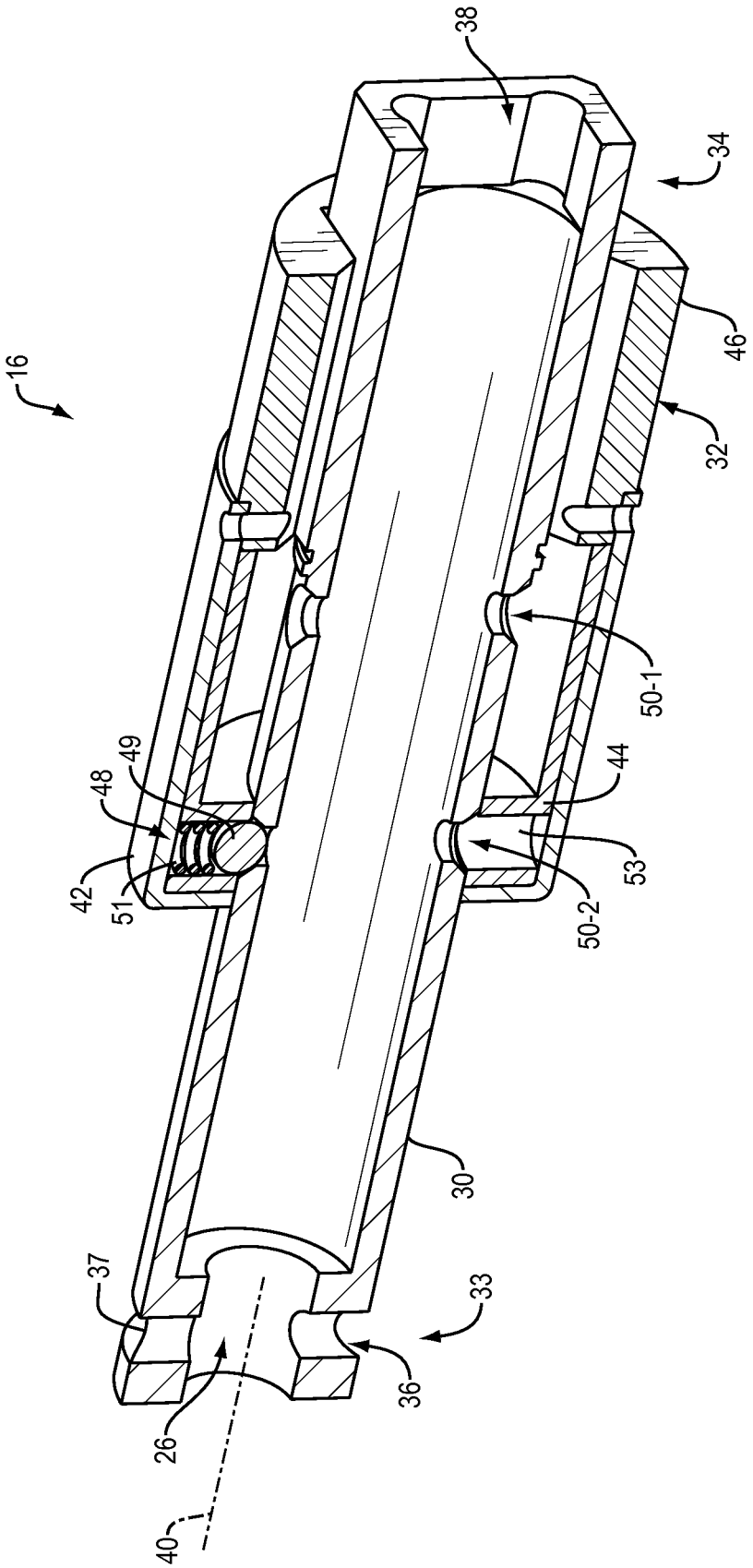

FIG. 4

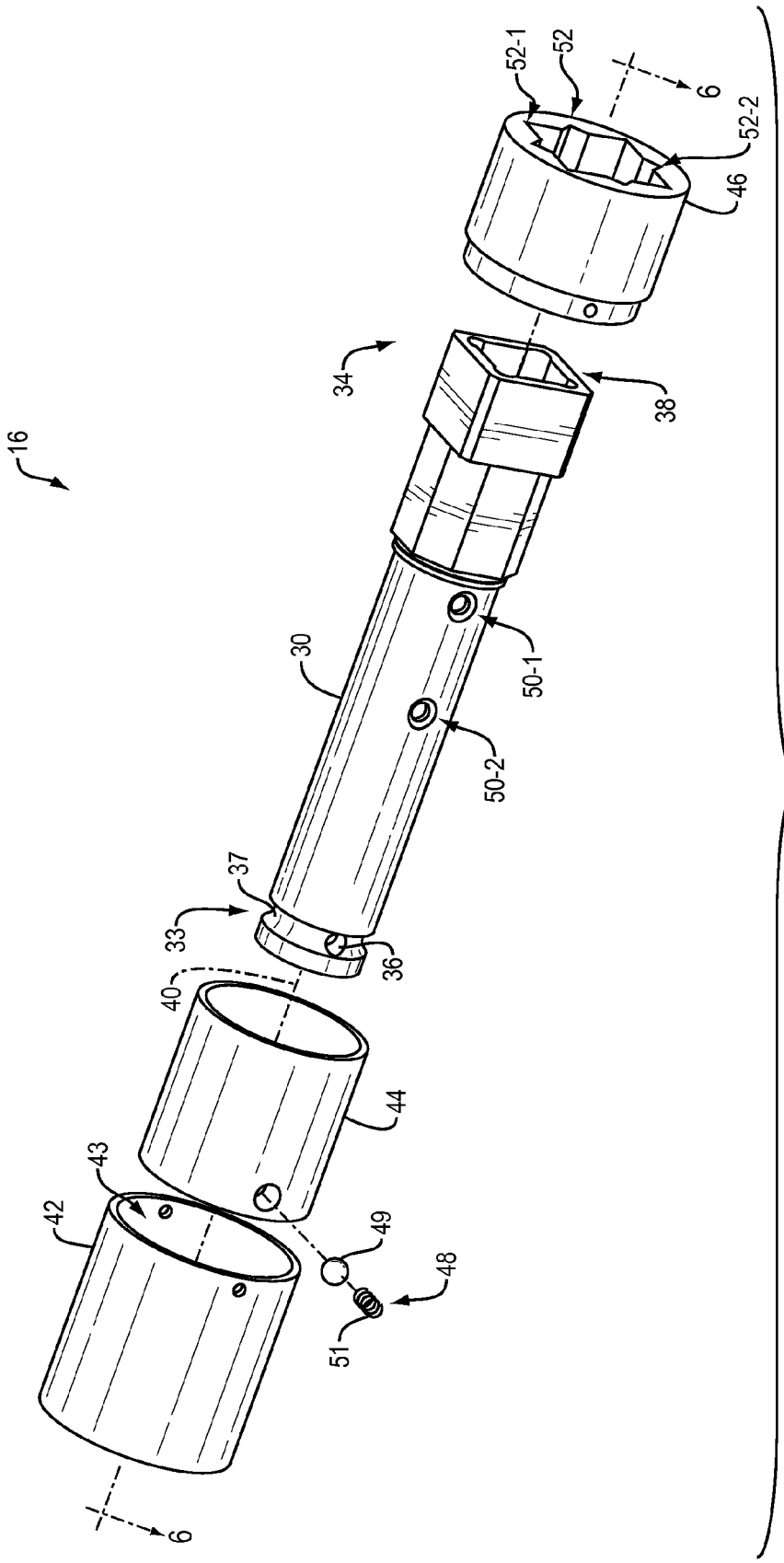

FIG. 5A

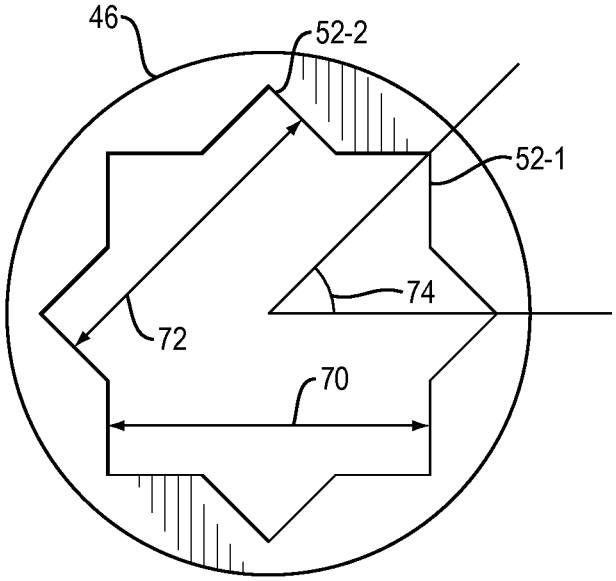

FIG. 5B

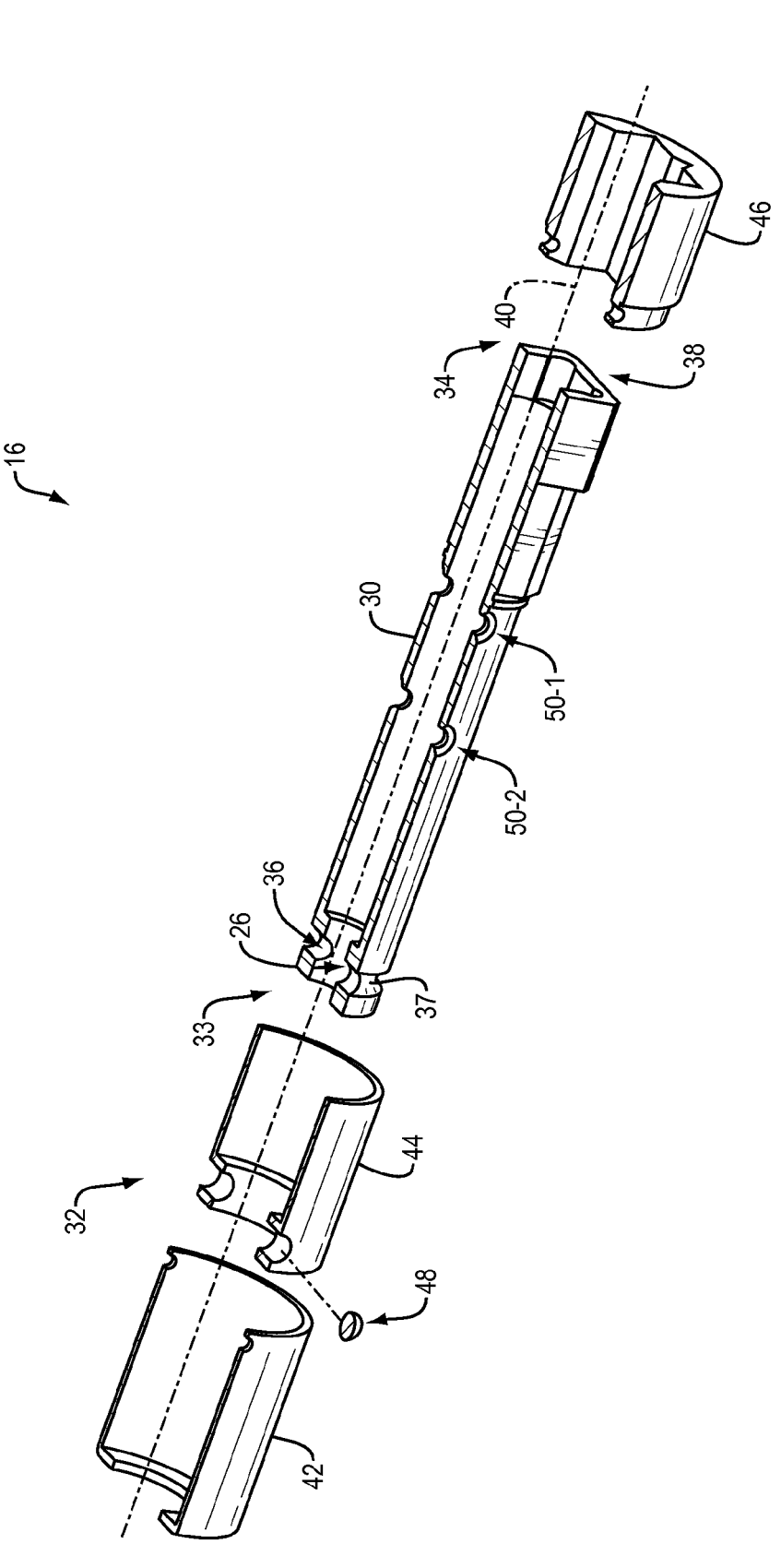

FIG. 6

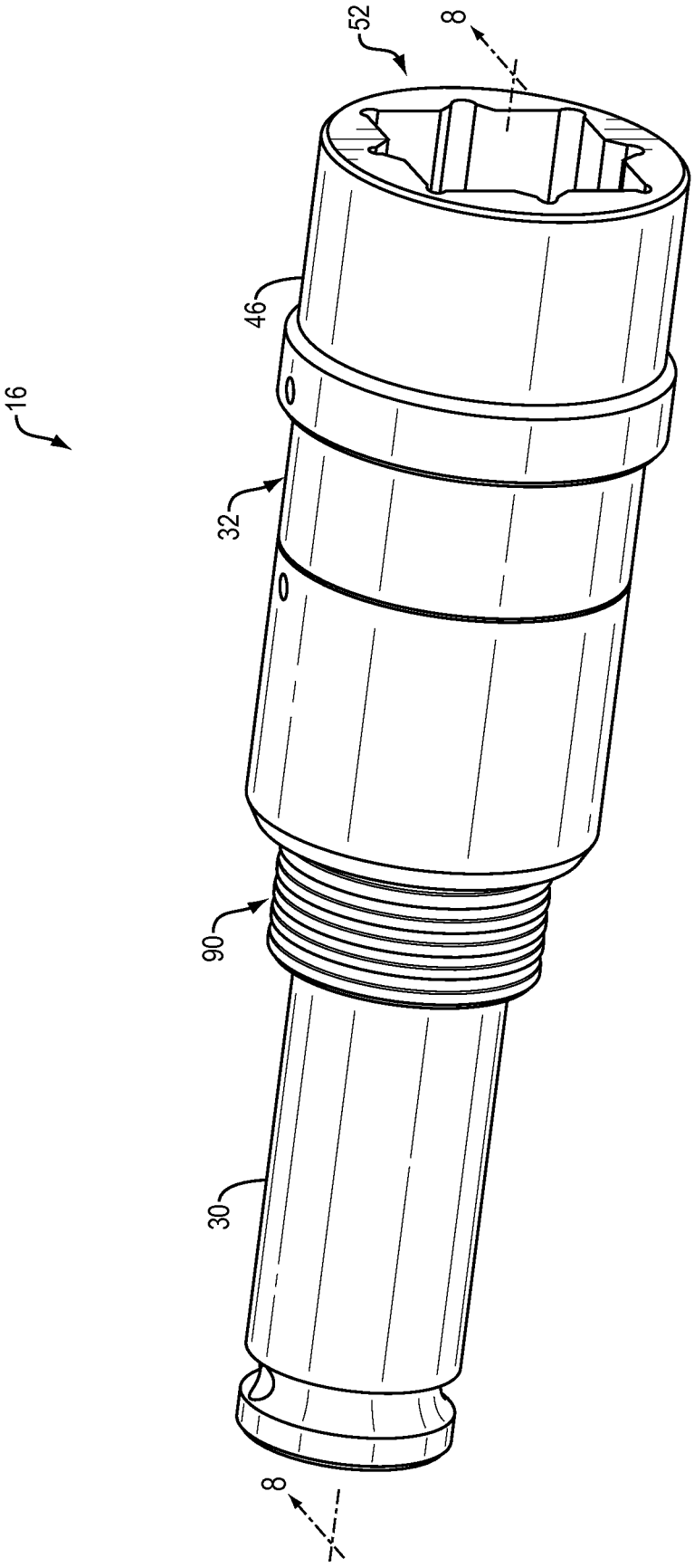

FIG. 7

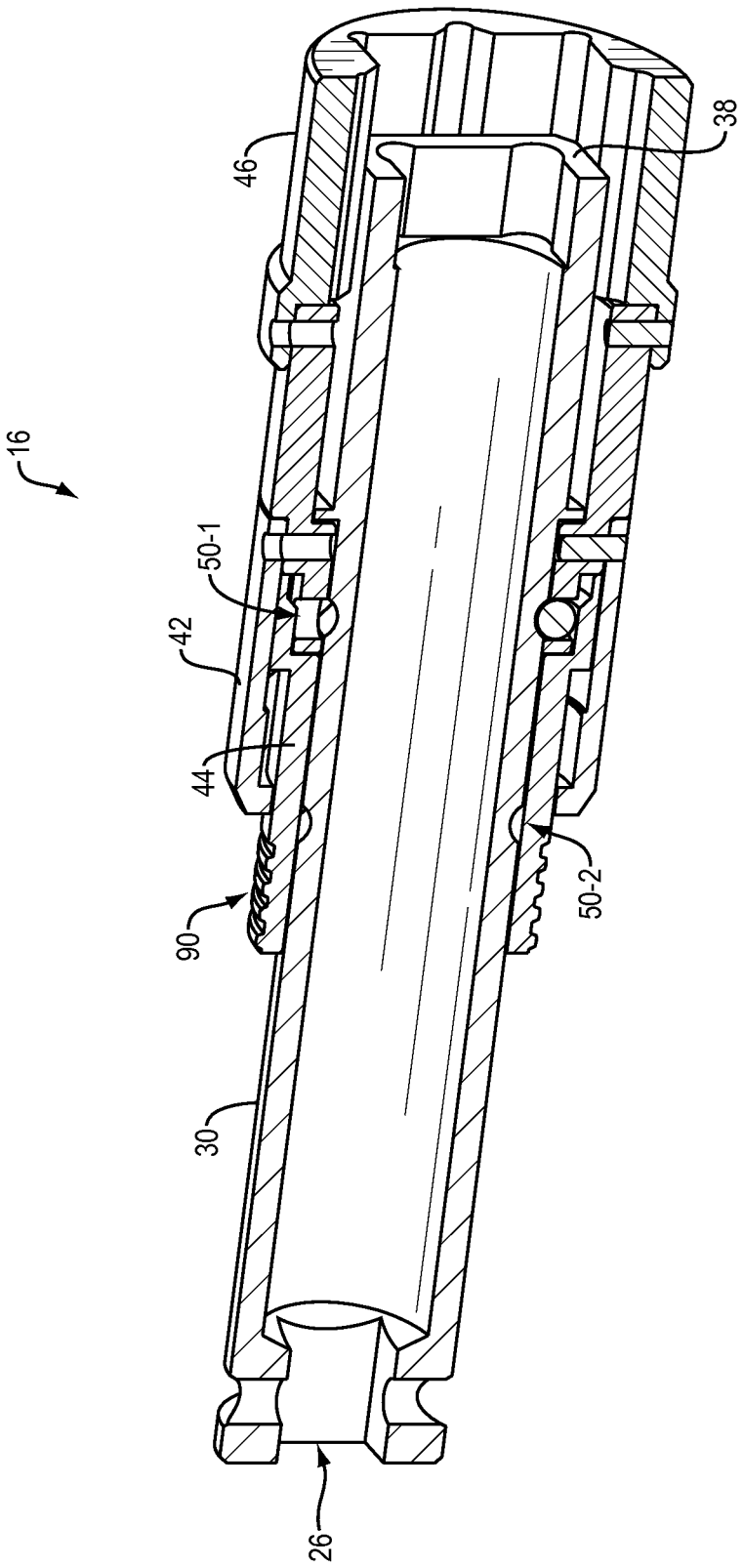

FIG. 8

IMPACT SOCKET

RELATED APPLICATIONS

This patent application claims the benefit of U.S. Provisional Application No. 61/710,297, filed on Oct. 5, 2012, entitled, "Impact Socket," the contents and teachings of which are hereby incorporated by reference in their entirety.

BACKGROUND

Conventional impact wrenches or impact guns are configured to deliver a relatively high output torque to associated impact sockets with minimum exertion by the user. For example, one end of a conventional impact socket is directly mounted to the drive shaft of an impact wrench while the opposing end of the impact socket is configured to engage a nut or bolt head. In use, pressurized air rotates a drive shaft of the impact wrench and provides a substantially precise output torque to the nut or bolt head via the impact socket.

SUMMARY

Conventional impact sockets suffer from a variety of deficiencies. For example, conventional impact sockets are sized and shaped to drive correspondingly-sized nuts or bolts. Accordingly, a one inch impact socket is configured to drive a one inch nut or bolt head while a 1⅛ inch impact socket is configured to drive a 1⅛ inch nut or bolt head.

In certain cases, an operator can encounter a variety of differently-sized nuts or bolt heads at a work site, such as fasteners having one inch and 1⅛ inch nuts or bolt heads. With conventional impact wrenches, operators are required to carry a relatively large number of impact sockets to a work site to accommodate a potentially wide variety of nut or bolt head sizes that can be encountered. Accordingly, there is an increased risk that the operator can lose or misplace one or more impact sockets of a set. Additionally, because conventional impact sockets are configured to drive only a single, correspondingly sized fastener, the operator can be required to repeatedly remove and attach appropriately sized impact sockets relative to the impact wrench over the course of a single job. This can reduce the operator's efficiency at the job site and can increase the overall costs in completing a task.

By contrast to conventional impact sockets, embodiments of the present innovation relate to an impact socket having a first end configured to mount to a drive shaft of an impact wrench and an opposing second end having a set of fastener driving structures. For example, the second end of the impact socket includes a collar assembly that defines one or more fastener driving structures at its distal end. The collar assembly is configured to move linearly between a first position and second position relative to a socket body of the impact socket. In the first position, the distal end of the collar assembly can extend beyond a distal end of the socket body such that a user can use the collar assembly fastener driving structure for driving a correspondingly sized nut or bolt head. In the second position, the distal end of the collar assembly is disposed proximal to the distal end of the socket body which also defines at least one fastener driving structure. With such positioning, the collar assembly exposes the distal end of the socket body and allows the user to utilize the socket body fastener driving structure for driving a correspondingly sized nut or bolt head.

Accordingly, the impact socket provides at least two distinct fastener driving structures at a single end. This configuration of the impact socket allows the user to select one of the fastener driving structures to drive a fastener without being required to remove the impact socket from the impact wrench. Accordingly, the configuration of the impact socket can improve operator efficiency and can reduce the risk of loss.

In one arrangement, an impact socket includes a socket body having a first end configured to mount to a drive shaft of an impact wrench and an opposing second end, the socket body defining at least one socket body fastener driving structure at the second end. The impact socket includes a collar assembly carried by the socket body, the collar assembly defining at least one collar assembly fastener driving structure. The collar assembly is configured to move linearly between (i) a first position relative to the socket body where a distal end of the collar assembly extends beyond a distal end of the socket body and (ii) a second position where the distal end is disposed at least equidistant to the second end of the socket body, the second end of the socket body defining a third fastener driving structure.

In one arrangement, an impact socket includes a socket body having a first end configured to mount to a drive shaft of an impact wrench and an opposing second end, the socket body defining at least one socket body fastener driving structure at the second end. The impact socket includes a collar assembly carried by the socket body, the collar assembly defining at least one collar assembly fastener driving structure. The collar assembly configured to be selectively secured to the socket body at (i) a first position relative to the socket body where a distal end of the collar assembly extends beyond a distal end of the socket body and (ii) a second position where the distal end is disposed at least equidistant to the second end of the socket body.

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing and other objects, features and advantages will be apparent from the following description of particular embodiments of the innovation, as illustrated in the accompanying drawings in which like reference characters refer to the same parts throughout the different views. The drawings are not necessarily to scale, emphasis instead being placed upon illustrating the principles of various embodiments of the innovation.

FIG. **1** illustrates a schematic representation of an exploded view of an impact wrench assembly, according to one arrangement.

FIG. **2** illustrates a perspective view of an impact socket having a collar assembly disposed in a first position along a longitudinal axis of a socket body, according to one arrangement.

FIG. **3** illustrates the impact socket FIG. **2** having the collar assembly disposed in a second position along the longitudinal axis of the socket body, according to one arrangement.

FIG. **4** illustrates a side sectional view of the impact socket shown in FIG. **3**, according to one arrangement.

FIG. **5**A illustrates an exploded view of the impact socket of FIG. **2**, according to one arrangement.

FIG. **5**B illustrates a front end view of the impact socket of FIG. **2**, according to one arrangement.

FIG. **6** illustrates a top sectional view of the impact socket illustrated in FIG. **5**, according to one arrangement.

FIG. **7** illustrates a perspective view of an impact socket having a collar assembly disposed in a first position along a longitudinal axis of a socket body, according to one arrangement.

FIG. **8** illustrates a side sectional view of the impact socket shown in FIG. **7**, according to one arrangement.

DETAILED DESCRIPTION

FIG. **1** illustrates an example schematic representation of an exploded view of an impact wrench assembly **10**. In one arrangement, the impact wrench assembly **10** includes an impact wrench **12**, an adaptor **14**, and an impact socket **16**. The adaptor **14** is configured to couple a drive shaft **18** of the impact wrench **12** to the impact socket **16**. In one arrangement, the drive shaft **18** includes a chuck **20** configured to receive a first end **24** of the adaptor **14** and secure the adaptor **14** to the impact wrench **12**. A second end **22** of the adaptor **14** is configured to be inserted within a chamber **26** defined by the impact socket **16** and secured to the impact socket **16** via a fastening mechanism (not shown), such as a ball detent assembly, pin, or position lock for example. In use, a user operates the impact wrench **12** to cause the drive shaft **18** to rotate the impact socket **16** about a longitudinal axis **28**.

In one arrangement, the impact wrench **12** generates a relatively large amount of torque on the impact socket **16**. To withstand the relatively large amount of torque, the impact socket **16** is manufactured from a relatively strong material, such as a 4100/4300 high carbon alloy steel, for example.

FIGS. **2-6** illustrate an example of the impact socket **16** shown schematically in FIG. **1**. As shown, the impact socket **16** includes a socket body **30** and a collar assembly **32** disposed thereon.

The socket body **30** includes a first end **33** configured to mount to a drive shaft **18** of an impact wrench **12** and an opposing second end **34** configured to drive a fastener. As indicated above, the first end **33** of the socket body **30** defines a chamber **26** configured to receive a second end **24** of an adaptor **14**. In one arrangement, the first end **33** of the socket body **30** is configured to receive and be coupled to the first end **22** of the adaptor **14**. For example, the first end **33** can define an opening **36** configured to receive a fastening mechanism such as a portion of a ball detent assembly, a pin, or a position lock (not shown). When the second end **24** of the adaptor **14** is disposed within the chamber **26**, insertion of the fastening mechanism within the opening **36** couples or secures the adaptor **14** to the impact socket **16**. Such coupling minimizes loosening of the adaptor **14** relative to the impact socket **16**, thereby minimizing inadvertent decoupling of the impact socket **16** relative to the impact wrench **12**.

In one arrangement, the opening **36** is defined within a groove or channel **37** extending about a circumference of the first end **33** of the socket body **30**. The groove **37** allows a user to dispose an O-ring at the first end **33** of the socket body **30** to cover the opening **36** and fastening mechanism to minimize introduction of contaminants into the chamber **26**.

With particular reference to FIGS. **3** and **4**, the socket body **30** defines at least one socket body fastener driving structure **38** at the opposing second end **34**. While the body fastener driving structure **38** can be configured with a variety of geometries, in one arrangement and with reference to FIGS. **3-6**, the socket body fastener driving structure **38** can be configured as a single, substantially square-shaped structure sized and shaped to receive a correspondingly sized and shaped fastener, such as a nut or bolt head. While the socket body fastener driving structure **38** can be configured in a variety of sizes, in one arrangement, the socket body fastener driving structure **38** is configured as having a ¾ inch square opening.

The collar assembly **32** is configured to translate longitudinally relative to a longitudinal axis **40** of the socket body **30**. In one arrangement, the collar assembly **32** includes a securing mechanism **48** configured to selectively secure the collar assembly **32** to the socket body **30**. For example, the securing mechanism can be configured as a ball **49** and spring mechanism **51** which selectively interfaces with detents **50** defined by the socket body **30**, such as first detent **50-1** and second detent **50-2**.

While the collar assembly **32** can be configured in a variety of ways, in one arrangement and with particular reference to FIGS. **4** through **6**, the collar assembly **32** includes a base sleeve **42**, a support sleeve **44**, and a fastener driving sleeve **46**.

In one arrangement, the base sleeve **42** and the support sleeve **44** are configured to maintain the positioning of the securing mechanism **48** relative to the socket body **30**. For example, with reference to FIG. **4**, the support sleeve **44** defines a chamber **53** which is configured, in part, to hold and constrain lateral movement of the ball **49** and spring mechanism **51** relative to the collar assembly **16**. Additionally, as indicated in FIG. **5**A, the support sleeve **44** is disposed within a chamber **43** defined by the base sleeve **42**. Based upon the relative positioning of the support sleeve **44** and the base sleeve **42**, the base sleeve **42** is configured as a cover for the chamber **53** to maintain the securing mechanism **48** therein.

The fastener driving sleeve **46** is coupled to the base sleeve **42** via a fastener and secures the support sleeve **44** within the chamber of the base sleeve **42**. The fastener driving sleeve **46**, in one arrangement, defines at least one collar assembly fastener driving structure **52** at its distal end. In one arrangement, with specific reference to FIGS. **2** and **5**A, the fastener driving sleeve **46** defines two coaxially-aligned fastener driving structures, such as a first collar assembly fastener driving structure **52-1** and a second collar assembly fastener driving structure **52-2**.

While the structures **52-1**, **52-2** can be configured as a variety of different shapes, in one arrangement, each of the collar assembly fastener driving structures **52-1**, **52-2** is defined as a substantially square-shaped structure that extends substantially along a length of the fastener driving sleeve **46**. For example, each of the fastener driving structures **52-1**, **52-2** defines four corners and four sides that extend along a length of the fastener driving sleeve **46**, as indicated in FIG. **6**. Accordingly, each of the fastener driving structures **52-1**, **52-2** is configured to receive and substantially surround a correspondingly sized and shaped fastener, such as a nut or bolt head during operation.

The collar assembly fastener driving structures **52-1**, **52-2** can be configured in a variety of sizes. With reference to FIG. **5**B, in one arrangement, the first collar assembly fastener driving structure **52-1** is configured with a first opening size **70**, such as a 1 inch square opening and the second collar assembly fastener driving structure **52-1** is configured with a second opening size **72** such as a 1⅛ inch square opening. Such a configuration allows an operator to adjust two differently sized fasteners at a worksite using a single fastener driving sleeve **46** without being required to remove and replace the impact socket **16** relative to the impact wrench **12**.

In order to accommodate multiple fastener driving structures, the fastener driving sleeve **46** defines the first and second fastener driving structures **52-1**, **52-1** as being rotationally offset from each other about the longitudinal axis **40** of the impact socket. For example, with continued reference to FIG. **5**B, the fastener driving sleeve **46** defines the second fastener driving structure **52-2** as being rotationally offset by an angle **74** of about 45° relative to the first fastener driving structure **52-1**.

The collar assembly **32** is configured to move linearly between a first position, as shown in FIG. **2**, and a second

position, as shown in FIG. **3**, relative to the socket body **30** of the impact socket **16** to provide a user with the distinctly-sized driving structures **38**, **52** at a single end of the device **16**. In one arrangement, in the first position, a portion of the fastener driving sleeve **46** can be at least equidistant to a distal or second end **34** of the socket body **30** to expose the first and second fastener driving structures **52-1**, **52-1** for use. For example, with reference to FIG. **2**, the securing mechanism **48** is disposed within the first detent **50-1** of the socket body **30** to secure the relative position of the collar assembly **32** to the socket body **30**. In this position, a portion of the fastener driving sleeve **46** can extend beyond a distal end **34** of the socket body **30** such that a user can select one of the two coaxially-aligned fastener driving structures **52-1**, **52-2** for driving a correspondingly sized nut or bolt head.

The user can translate the collar **32** along direction **60**, as shown in FIG. **2**, for a given distance, such as a distance of about 2 inches, to place the collar assembly **32** in the second position. For example, by applying a translation force to the collar **32** relative to the socket body **30**, the translation force can overcome the spring force generated by the spring **51** on the ball **49** to extract the ball **49** from the first detent **50-1** and allow the securing mechanism **48** to translate along the socket body **30** to the second detent **50-2**. In the second position, with reference to FIGS. **3** and **4**, the securing mechanism **48** is disposed within the second detent **50-2** of the socket body **30** to secure the relative positioning of the collar assembly **32** to the socket body **30**. In this position, the fastener driving sleeve **46** is disposed proximal to the distal end **34** of the socket body **30** which exposes the socket body fastener driving structure **38** for use such that the user can drive a correspondingly sized nut or bolt head.

While various embodiments of the innovation have been particularly shown and described, it will be understood by those skilled in the art that various changes in form and details may be made therein without departing from the spirit and scope of the innovation as defined by the appended claims.

For example, as indicated above, the impact socket **16** provides an operator with at least two distinctly sized fastener driving structures **38**, **52**, each of which defines an opening, such as a square opening. Such indication is by way of example only. In one arrangement, each fastener driving structure can define any opening shape, such as a hexagonally shaped opening, a pentagon shaped opening, or a custom spline shaped opening. Additionally, it should be noted that each of the fastener driving structures **38**, **52** can have relatively different shaped openings. For example, the socket body fastener driving structure **38** can be configured with a pentagon shape and the collar assembly fastener driving structure **52** can be configured with a hexagonal shape. Alternately, for example, the socket body fastener driving structure **38** can be configured with a hexagonal shape and the collar assembly fastener driving structure **52** can be configured with a pentagon shape. Furthermore, in the case of the spline shaped opening, in one arrangement the socket body fastener driving structure **38** can be configured with a single spline that drives one or more nut or bolt head shapes (e.g., square and hexagonal shaped nuts) and the collar assembly fastener driving structure **52** can be configured with a single spline that drives one or more nut or bolt head shapes (e.g., square and hexagonal shaped nuts).

In another example, the collar assembly **32** is described as having two collar assembly fastener driving structures **52-1**, **52-2**. Such description is by way of example only. In one arrangement, the collar assembly **32** is configured with at least three collar assembly fastener driving structures.

In another example, the socket body **30** is described as defining a single socket body fastener driving structure **38**. Such description is by way of example only. In one arrangement, the socket body **30** is configured with at least two socket body fastener driving structure **38**.

In another example, the first end **33** of the socket body **30** is described as defining a chamber **26** configured to receive a second end **24** of an adaptor **14**. As indicated in FIG. **4**, the chamber **26** is defined as a substantially cylindrically-shaped volume. Such illustration is by way of example only. In one arrangement, as indicated in FIG. **8**, the chamber **26** is defined as a substantially rectangular volume. With such a configuration, the socket body can interface with the adaptor end **22**, as illustrated in FIG. **1**.

In another example, with reference to FIGS. **7** and **8**, the collar assembly defines a set of ridges **90** disposed at least partly about an outer surface of the collar assembly **32**. In one arrangement, the ridges provide an operator with a surface for grasping when positioning the collar assembly **32** relative to the socket body **30**.

What is claimed is:

1. An impact socket, comprising:

a socket body having a first end configured to mount to a drive shaft of an impact wrench and an opposing second end, the socket body defining at least one socket body fastener driving structure at the second end;

a collar assembly carried by the socket body, the collar assembly defining at least one collar assembly fastener driving structure, the collar assembly being configured to move linearly between (i) a first position relative to the socket body where a distal end of the collar assembly extends beyond the second end of the socket body and (ii) a second position where the distal end of the collar assembly is disposed at least equidistant to the second end of the socket body; and

a securing mechanism carried by the collar assembly, the securing mechanism configured (i) to secure the collar assembly to the socket body when the collar assembly is disposed in the first position and (ii) to secure the collar assembly to the socket body when the collar assembly is disposed in the second position;

wherein the collar assembly comprises

a support sleeve defining a chamber configured to constrain lateral movement of the securing mechanism relative to the collar assembly, and

a base sleeve defining a chamber, the support sleeve disposed within the chamber defined by the base sleeve and the base sleeve configured to maintain the securing mechanism within the chamber defined by the support sleeve.

2. The impact socket of claim **1**, wherein, in the second position, the distal end of the collar assembly is disposed proximal to the second end of the socket body.

3. The impact socket of claim **1**, wherein the at least one socket body fastener driving structure defines a substantially square opening that extends along a longitudinal axis of the at least one socket body fastener driving structure.

4. The impact socket of claim **1**, wherein the collar assembly defining the at least one collar assembly fastener driving structure comprises a fastener driving sleeve that defines a first fastener driving structure and a second fastener driving structure, the first fastener driving structure configured to drive a first sized fastener and the second fastener driving structure configured to drive a second sized fastener, the first sized fastener being distinct from the second sized fastener.

5. The impact socket of claim 4, wherein the fastener driving sleeve defines the first fastener driving structure at a rotational offset relative to the second fastener driving structure.

6. The impact socket of claim 1, wherein:

the securing mechanism comprises a ball and spring mechanism; and

the collar assembly defines a first detent and a second detent, the ball and spring mechanism configured to engage the first detent when the collar assembly is disposed in the first position and to engage the second detent when the collar assembly is disposed in the second position.

7. The impact socket of claim 1, wherein the collar assembly defines a set of ridges disposed at least partly about an outer surface of the collar assembly.

8. An impact socket, comprising:

a socket body having a first end configured to mount to a drive shaft of an impact wrench and an opposing second end, the socket body defining at least one socket body fastener driving structure at the second end;

a collar assembly carried by the socket body, the collar assembly defining at least one collar assembly fastener driving structure, the collar assembly configured to be selectively secured to the socket body at (i) a first position relative to the socket body where a distal end of the collar assembly extends beyond the second end of the socket body and (ii) a second position where the distal end of the collar assembly is disposed at least equidistant to the second end of the socket body; and

a securing mechanism carried by the collar assembly, the securing mechanism configured to (i) selectively secure the collar assembly to the socket body when the collar assembly is disposed in the first position and (ii) selectively secure the collar assembly to the socket body when the collar assembly is disposed in the second position;

wherein the collar assembly comprises:

a support sleeve defining a chamber configured to constrain lateral movement of the securing mechanism relative to the collar assembly, and

a base sleeve defining a chamber, the support sleeve disposed within the chamber defined by the base sleeve and the base sleeve configured to maintain the securing mechanism within the chamber defined by the support sleeve.

9. The impact socket of claim 8, wherein, in the second position, the distal end of the collar assembly is disposed proximal to the second end of the socket body.

10. The impact socket of claim 8, wherein the at least one socket body fastener driving structure defines a substantially square opening that extends along a longitudinal axis of the at least one socket body fastener driving structure.

11. The impact socket of claim 8, wherein the collar assembly defining the at least one collar assembly fastener driving structure comprises a fastener driving sleeve that defines a first fastener driving structure and a second fastener driving structure, the first fastener driving structure configured to drive a first sized fastener and the second fastener driving structure configured to drive a second sized fastener, the first sized fastener being distinct from the second sized fastener.

12. The impact socket of claim 11, wherein the fastener driving sleeve defines the first fastener driving structure at a rotational offset relative to the second fastener driving structure.

13. The impact socket of claim 8, wherein:

the securing mechanism comprises a ball and spring mechanism; and

the collar assembly defines a first detent and a second detent, the ball and spring mechanism configured to engage the first detent when the collar assembly is disposed in the first position and to engage the second detent when the collar assembly is disposed in the second position.

14. The impact socket of claim 8, wherein the collar assembly defines a set of ridges disposed at least partly about an outer surface of the collar assembly.

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